LOAN DOCUMENT

PHOTOGRAPH THIS SHEET

LEVEL

0

INVENTORY

DTIC ACCESSION NUMBER

BIOVENTING PILOT TEST WORK...

DOCUMENT IDENTIFICATION

FEB 96

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

DISTRIBUTION STATEMENT

ACCESSION FOR
NTIS GRA&I ☑
DTIC TRAC ☐
UNANNOUNCED ☐
JUSTIFICATION

BY
DISTRIBUTION/
AVAILABILITY CODES
DISTRIBUTION | AVAILABILITY AND/OR SPECIAL

A-1

DISTRIBUTION STAMP

DATE ACCESSIONED

DATE RETURNED

20001226 046

DATE RECEIVED IN DTIC

REGISTERED OR CERTIFIED NUMBER

HANDLE WITH CARE

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-FDAC

DTIC FORM JUN 90 70A

DOCUMENT PROCESSING SHEET

PREVIOUS EDITIONS MAY BE USED UNTIL STOCK IS EXHAUSTED.

LOAN DOCUMENT

FINAL

Bioventing Pilot Test Work Plan for Building 675 LPST Site Fort Bliss, Texas

Prepared For

The U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

Fort Bliss
El Paso, Texas

and

Air Force Center for Environmental Exellence
Brooks Air Force Base
San Antonio, Texas

February 1996

PARSONS
ENGINEERING SCIENCE, INC.
8000 Centre Park Drive, Suite 200 • Austin, Texas 78754

AQM01-03-0579

DEFENSE TECHNICAL INFORMATION CENTER
REQUEST FOR SCIENTIFIC AND TECHNICAL REPORTS

Title AFCEE Collection

1. Report Availability *(Please check one box)*

☒ This report is available. *Complete sections 2a - 2f.*
☐ This report is not available. *Complete section 3.*

2a. Number of Copies Forwarded 1 each

2b. Forwarding Date July/2000

2c. Distribution Statement *(Please check ONE box)*

DoD Directive 5230.24, "Distribution Statements on Technical Documents," 18 Mar 87, contains seven distribution statements, as described briefly below. Technical documents MUST be assigned a distribution statement.

☒ DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

☐ DISTRIBUTION STATEMENT B: Distribution authorized to U.S. Government Agencies only.

☐ DISTRIBUTION STATEMENT C: Distribution authorized to U.S. Government Agencies and their contractors.

☐ DISTRIBUTION STATEMENT D: Distribution authorized to U.S. Department of Defense (DoD) and U.S DoD contractors only.

☐ DISTRIBUTION STATEMENT E: Distribution authorized to U.S. Department of Defense (DoD) components only.

☐ DISTRIBUTION STATEMENT F: Further dissemination only as directed by the controlling DoD office indicated below or by higher authority.

☐ DISTRIBUTION STATEMENT X: Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with DoD Directive 5230.25, Withholding of Unclassified Technical Data from Public Disclosure, 6 Nov 84.

2d. Reason For the Above Distribution Statement *(in accordance with DoD Directive 5230.24)*

2e. Controlling Office

HQ AFCEE

2f. Date of Distribution Statement Determination

15 Nov 2000

3. This report is NOT forwarded for the following reasons. *(Please check appropriate box)*

☐ It was previously forwarded to DTIC on .... *(date)* and the AD number is ....

☐ It will be published at a later date. Enter approximate date if known. ....

☐ In accordance with the provisions of DoD Directive 3200.12, the requested document is not supplied because:

Print or Type Name
Laura Peña

Signature
Laura Peña

Telephone
210-536-1431

(For DTIC Use Only)
AQ Number M01-03-0579

Final
Bioventing Pilot Test Work Plan
for Building 675 LPST Site
Fort Bliss, Texas

Prepared for

Fort Bliss
El Paso, Texas

Prepared by

Parsons Engineering Science, Inc.
Austin, Texas

February 1996

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

BIOVENTING PILOT TEST WORK PLAN FOR BUILDING 675 LPST SITE FORT BLISS, TEXAS

1.0 INTRODUCTION

This work plan presents the scope of a multi-phase bioventing pilot test for *in situ* treatment of fuel-contaminated soils at Building 675, Fort Bliss, Texas. The location of the site is presented on Figure 1.1. The pilot test will be performed by Parsons Engineering-Science, Inc. (Parsons ES) for Fort Bliss and the United States Army Environmental Center (USAEC) through a contract with the Air Force Center for Environmental Excellence (AFCEE). The three primary objectives of the proposed pilot tests are: 1) to assess the potential for supplying oxygen throughout the contaminated soil interval, 2) to determine the rate at which indigenous microorganisms will degrade fuel when supplied with oxygen-rich soil gas, and 3) to evaluate the potential for sustaining these rates of biodegradation until fuel contamination is remediated to concentrations below regulatory standards.

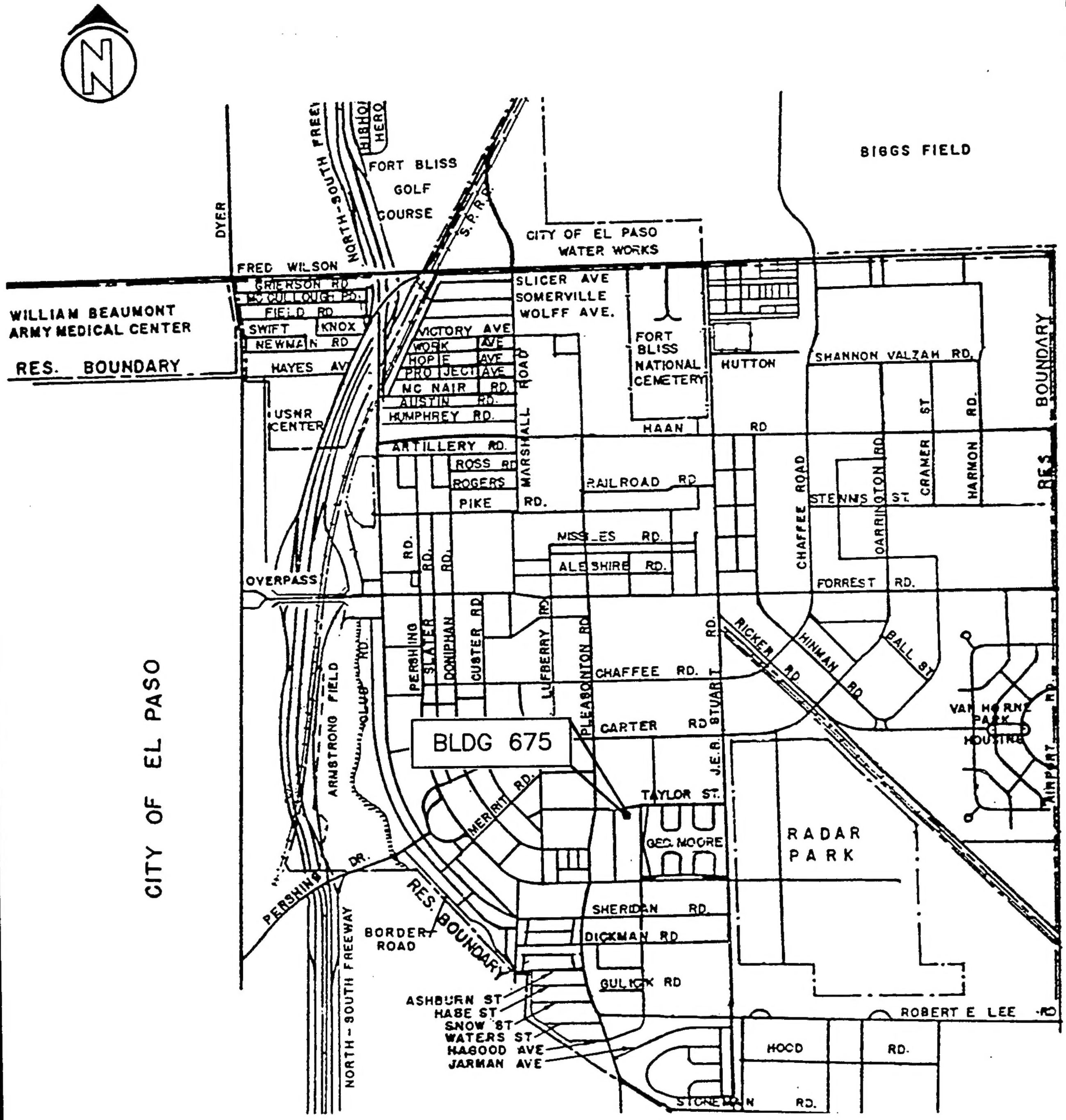
The pilot tests will be conducted in two phases. A vent well (VW) and four vapor monitoring points (MPs) will be installed during site investigation activities. The locations of the VW and MPs will be determined based on the results of a limited soil gas survey to be performed at the site as part of this pilot test. The initial test phase at the site will also include an *in situ* respiration test, an air permeability test, and installation of a blower system for air injection. This initial testing is expected to take approximately 2 weeks. During the second phase, the bioventing systems will be operated and monitored over a 1-year extended pilot testing period.

If bioventing proves to be an effective means of remediating soil contamination at this site, pilot test data may be used to design full-scale remediation systems and to estimate the time required for site cleanup. An added benefit of the pilot testing is that a significant amount of the fuel contamination should be biodegraded during the 1-year pilot test, as the testing will take place within the most contaminated soils. Additional background information on the development and recent success of the bioventing technology is found in the document entitled *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing* (Hinchee *et al.*, 1992). This protocol document will serve as the primary reference for pilot test well design and the detailed procedures to be used during the test.

2.0 SITE DESCRIPTION

2.1 Site History and Location

Building 675 was used as a gasoline service station from approximately 1951 through 1985. Two leaking petroleum storage tank (LPST) sites were investigated in the vicinity of Building 675. In 1991, three gasoline storage tanks, assigned state LPST identification (ID) number 98508, were removed from just northeast of the building [EA Remediation Technologies, Inc. (EA), 1991], and in 1994, a fourth waste



FORT BLISS, TEXAS
ROAD & STREET MAP
NO SCALE

FIGURE 1.1
SITE LOCATION
LPST NO.98508
BUILDING 675
PILOT TEST WORK PLAN
FT. BLISS, TEXAS

oil tank, LPST ID No. 109924, was abandoned underneath the southern edge of the building. The locations of all four tanks are shown on Figure 2.1. The focus of this pilot test is the three-tank excavation located north of the building.

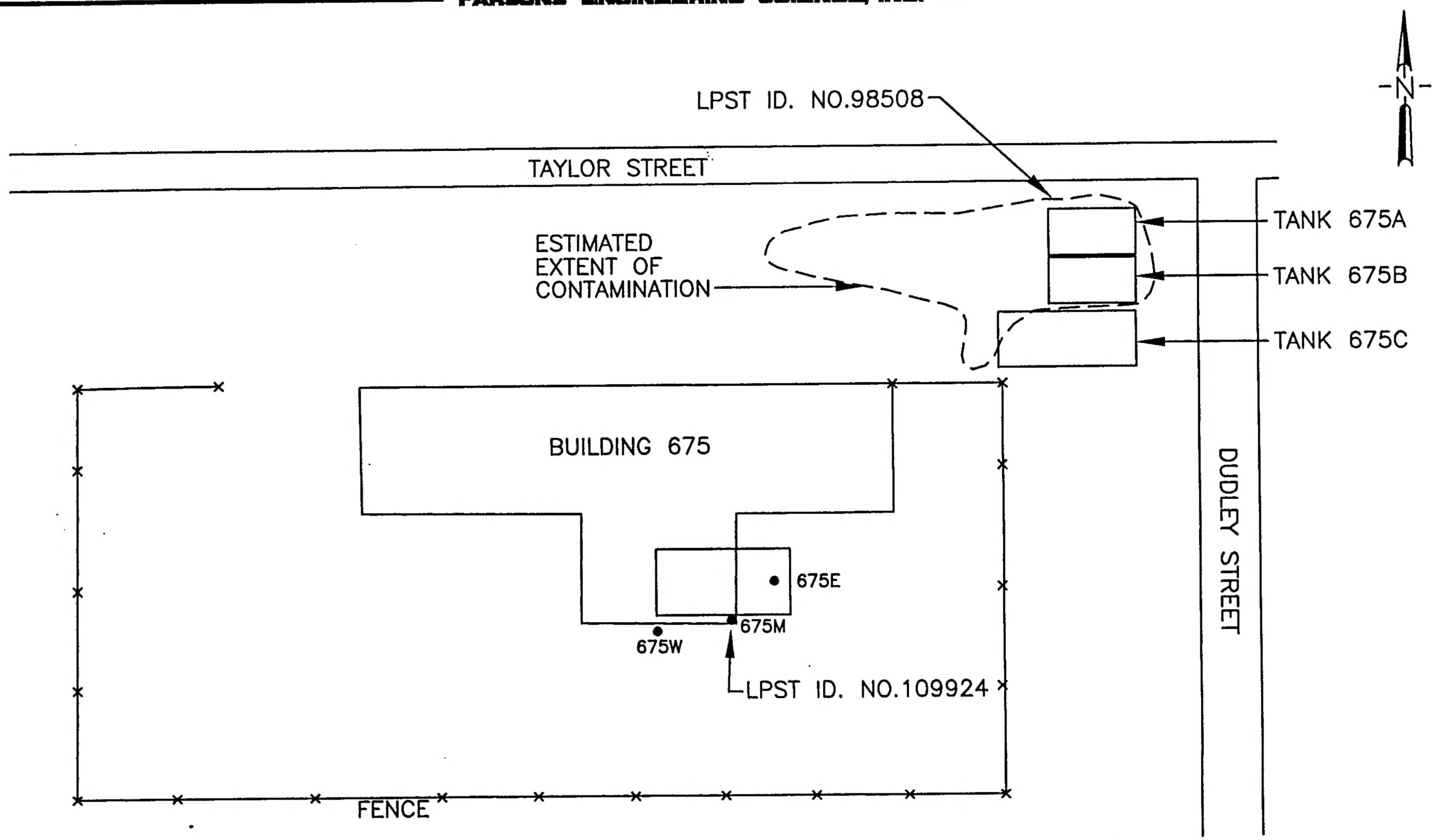
The three tanks were installed around 1951 and were reportedly last used in 1985. The orientation of the tanks is shown on Figure 2.1. The locations of the pump islands and trench relative to the excavation limits is shown on Figure 2.2. All three were constructed of single-walled steel, each with a reported capacity of 10,000 gallons. The tanks were used to store leaded and unleaded gasoline. Upon removal of the tanks on January 17, 1991, several small pinholes were observed on the bottom of tank 675A, tank 675B had several corrosion holes on the bottom, but tank 675C was reportedly in good condition [Texas Water Commission (TWC), 1991].

The UST excavation was approximately 35 feet by 50 feet along the northern end of the pump islands to a depth of approximately 16 feet below ground surface (bgs). The excavation extended approximately 3 feet deep and 140 feet along the pump islands for removal of ancillary equipment, such as fuel lines. Soil contamination was observed in the tank pit during removal actions, suggesting that an unknown amount of gasoline was released into the soil from tanks 675A and 675B (EA, 1991). A total of 19 soil samples were collected from the walls and the pit bottom and from along the fuel line trench leading to the pump islands. These samples were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and total recoverable petroleum hydrocarbons (TRPH). The limits of contamination were estimated based on the sample results, and are shown on Figure 2.1.

Over-excavation to remove all contaminated soil from the pit was attempted; however, the contamination seemed to extend "straight down" beneath the tanks, and the vertical extent of contamination was not determined (Ayub, 1991). A thin plastic liner was placed in the excavated pit prior to backfilling with clean fill material.

2.2 Site Geology and Soils

The site is located on Holocene-age Quaternary lacustrine and fluviatile deposits of clay, silt, sand, and gypsum bolsons (BEG, 1983). The individual beds vary in thickness and range from a fraction of an inch to hundreds of feet thick [Texas Water Development Board (TWDB), 1980]. These deposits are a result of the erosion of the Franklin Mountains located to the west. Soil borings drilled by Parsons ES approximately 2 miles northeast of the site contained primarily sand and gravel with an occasional caliche or silty clay layer to a depth of approximately 40.5 feet bgs (Parsons ES, 1995). Logs of nearby wells obtained from TWC files confirm this stratigraphy by indicating that there are sand layers separated by clay layers to a depth of at least 1,200 feet bgs. The depth to the uppermost aquifer used as a water source is approximately 250 feet in the Hueco Bolson deposits. Discontinuous perched groundwater zones have been encountered at Fort Bliss at depths of less than 100 feet bgs.



NOTE: ALL LOCATIONS ARE APPROXIMATE, NOT TO SCALE

FIGURE 2.1
SITE PLAN
LPST NO.98508

PILOT TEST WORK PALN
FORT BLISS, TEXAS

FBLISSIT 1/30/96

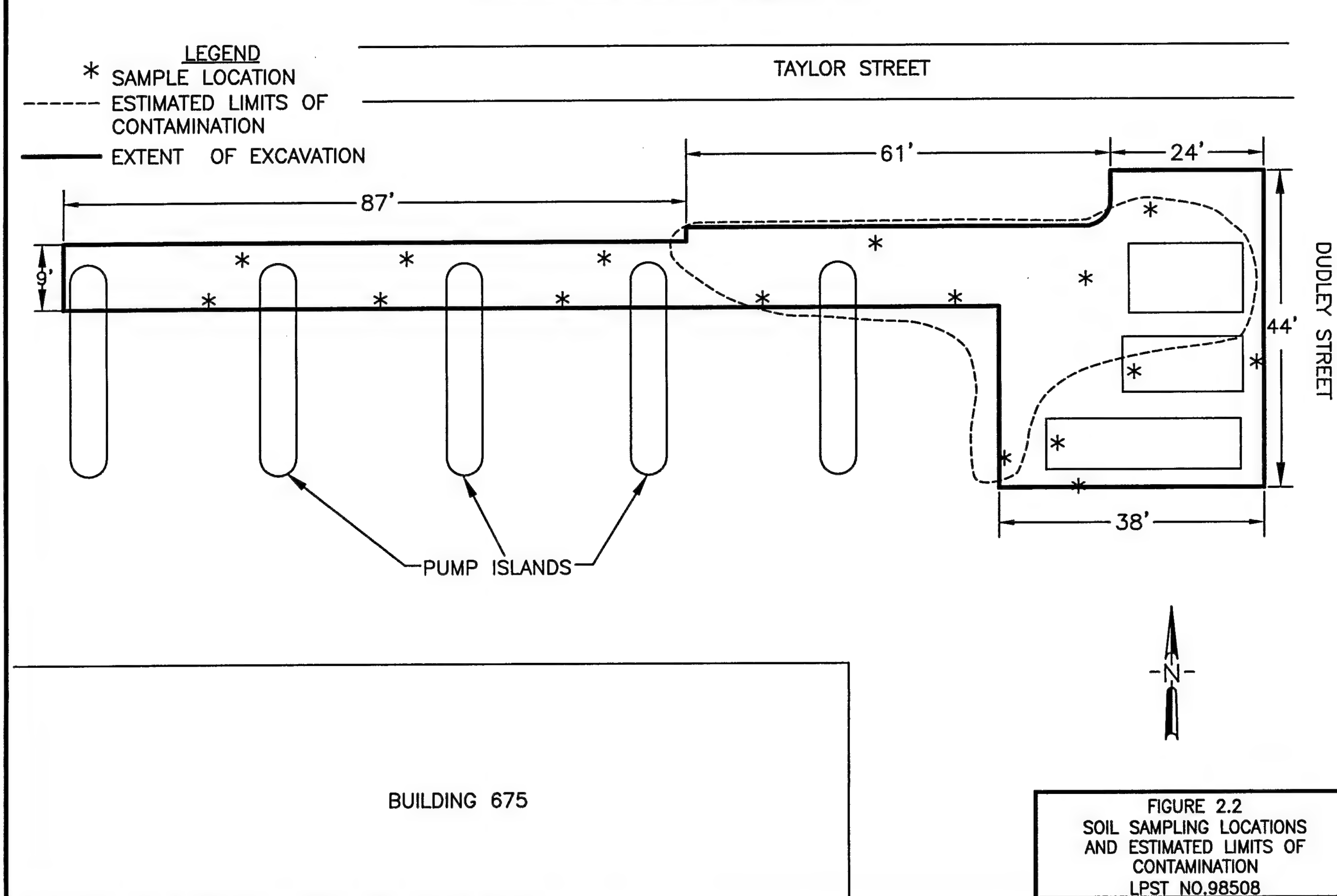


FIGURE 2.2
SOIL SAMPLING LOCATIONS AND ESTIMATED LIMITS OF CONTAMINATION
LPST NO.98508
FORT BLISS, TEXAS

SOURCE: FIELD SKETCH FROM FORT BLISS FILES

FBLISSIT 1/30/96

According to the soil survey for El Paso County, Texas, the soils at the site are part of the Hueco-Wink Association [Soil Conservation Service (SCS), 1971]. These soils are characterized as nearly level and gently sloping soils that have a fine sandy loam subsoil and are moderately deep over caliche. The permeability of these soils is moderate, ranging from 1.4 x E-03 to 4.4 x E-03 centimeter per second (2 to 6.3 inches per hour). The excavated soil from around the gasoline LPSTs was described as sandy (EA, 1991). A density test conducted on the excavated soil around the waste oil tank (LPST No. 109924) describes the soil as a silty sand (Laidlaw, 1994). Analytical results from the samples collected around the waste oil tank show soil moisture ranging from 6 to 9 percent.

2.3 Site Contaminants

A total of 19 soil samples were collected during the removal of the three gasoline tanks in January 1991 (EA, 1991). The orientation of the samples around the excavation area is shown on Figure 2.2. However, sample locations were not identified in any report, so detected contaminant concentrations cannot be correlated with actual sample locations. The limits of contamination were estimated based on a figure in the Fort Bliss site files. TRPH ranged from less than 5 milligrams per kilograms (mg/kg) (nondetect) to 2,870 mg/kg, and total BTEX levels ranged from less than 0.08 micrograms per kilogram (μg/kg) (nondetect) to 1,264.5 μg/kg. Reportedly contamination was not detected on the excavation side walls, but was detected on the bottom of the excavation (Ayub, 1991). Contamination persists to at least 16 feet bgs (the bottom of the excavation). Analytical results are presented in Table 2.1.

3.0 PILOT TEST ACTIVITIES

The purpose of this section is to describe the pilot test activities planned for this site. The proposed locations and construction details for the central VW and vapor MPs are described, and criteria for locating a suitable background well position are outlined. Soil and soil gas sampling procedures and the blower configuration that will be used to inject air (oxygen) into contaminated soils are also discussed in this section. Finally, a brief description of the pilot test procedures is provided.

The bioventing technology is intended to remediate contamination only in the unsaturated zone. Therefore, pilot test activities will be confined to unsaturated soils. Additionally, before beginning drilling, a soil gas survey will be performed to locate the area of the site where vadose zone soils are most depleted of oxygen. Anaerobic conditions in subsurface soils are usually indicative of contamination, with low oxygen levels resulting from biodegradation of fuel hydrocarbons by aerobic bacteria. The soil gas survey will screen for oxygen, carbon dioxide, and total volatile hydrocarbons (TVH).

3.1 Bioventing Test Design

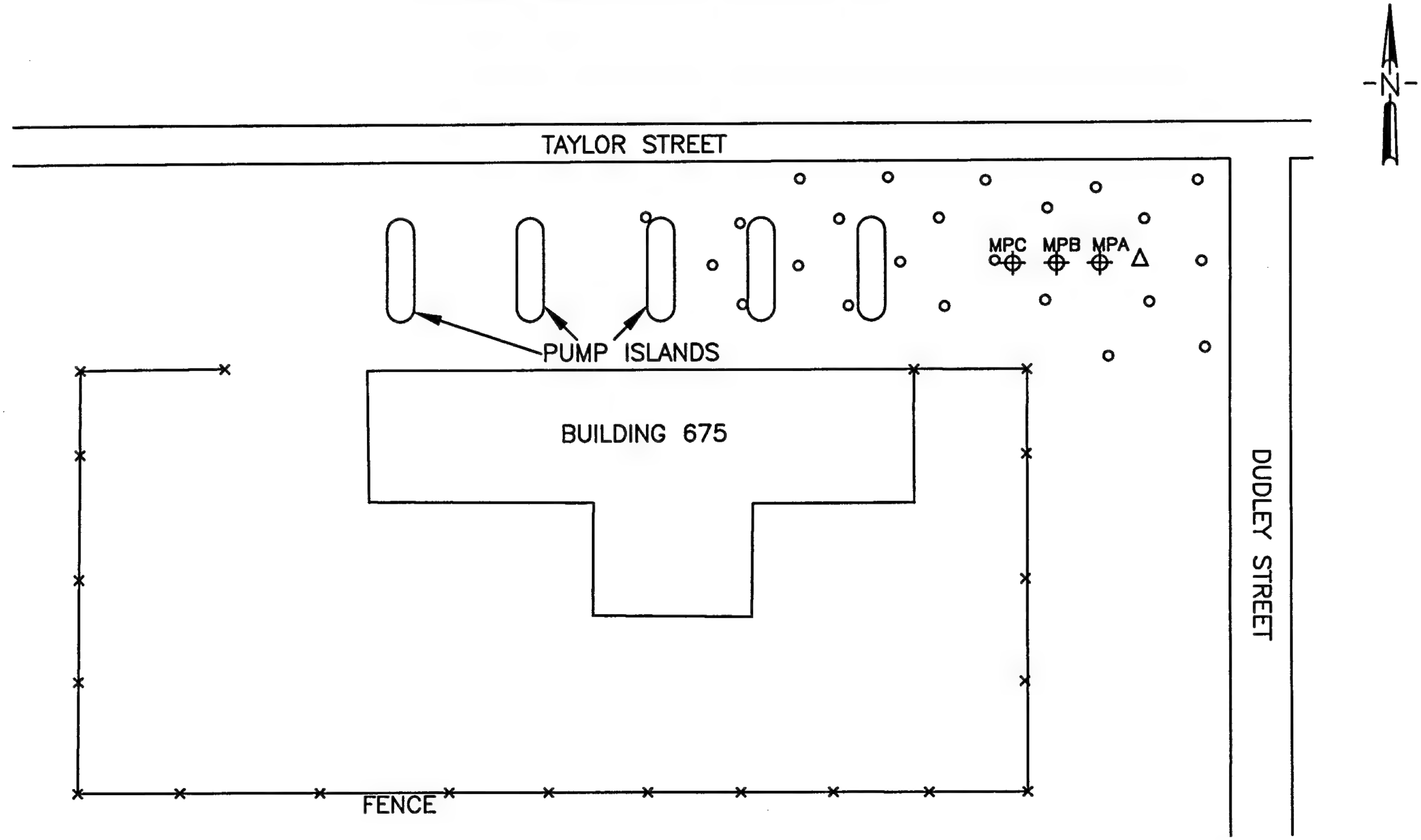
A general description of criteria for siting a central VW and vapor MPs is included in the protocol document (Hinchee *et al.*, 1992). Figure 3.1 illustrates the proposed

Table 2.1 Gasoline Tank Removal Soil Analytical Results, LPST ID No. 98508
Building 675
Fort Bliss, Texas

Chemical	675 Hole	675 Wall D	675 Trench 3	675 Trench 4	675 Trench 5	675 Hole A	675 Trench 1	675 Tank A	675 Tank B	675 Tank C	675 Wall A	675 Wall B	675 Wall C	675 Wall D	675 Hole #1	675 Hole #2	675 Hole #3	675 Hole #4	675 Hole #5
BTEX (µg/kg)																			
Method SW8020																			
Benzene	<0.4	<0.02	<0.02	<0.02	<0.02	<0.25	<0.02	<0.80	<0.04	<0.02	<0.02	<0.02	<0.4	<0.04	<0.4	0.435	15.5	<0.02	<0.02
Toluene	12.4	0.034	<0.02	<0.02	<0.02	<0.25	<0.02	1.4	<0.04	<0.02	<0.02	<0.02	0.783	<0.04	22.7	7.75	364	0.044	0.04
Ethylbenzene	15.5	0.046	<0.02	<0.02	<0.02	<0.25	0.061	4.32	<0.04	<0.02	<0.02	<0.02	5.2	<0.04	15.8	3.52	177	<0.02	<0.02
Xylenes	80.9	0.265	<0.02	<0.02	<0.02	<0.25	0.251	44.7	0.549	<0.02	<0.02	<0.02	42.7	1.28	67.4	16.7	708	0.125	<0.024
Total BTEX (µg/kg)	108.8	0.345	<0.08	<0.08	<0.08	<1.0	0.31	50.42	0.55	<0.08	<0.08	<0.08	48.68	1.28	105.9	28.4	1264.5	0.17	0.06
Total Recoverable Petroleum Hydrocarbons (mg/kg) Method EPA 418.1	642	24.9	51.2	166	77.4	1320	547	260	174	30.1	<5	11.7	1640	223	1490	498	2870	286	217

Note: Samples collected in January 1991 by E.A. Remediation Technologies, Inc.
Samples analyzed by Sunbelt Laboratories, Inc. (1991) in El Paso, Texas.

CPQ4040/726876/TNKRMVL.XLS



NOT TO SCALE

LEGEND

- ○ PROPOSED SOIL GAS SURVEY GRID POINT
- Δ PROPOSED VENT WELL LOCATION
- ⊕ PROPOSED VAPOR MONITORING POINT LOCATION

FIGURE 3.1
PROPOSED
SOIL GAS SURVEY GRID,
VENT WELL, AND
MONITORING POINT LOCATIONS
LPST NO.98508
FORT BLISS, TEXAS

FBLISSIT 1/30/96

locations of the central VW and MPs at this site. The exact location of the VW and vapor MPs will be selected in the field, subject to final approval by Fort Bliss. The final locations may vary from the proposed locations based on the results of the soil gas survey, or if significant fuel contamination is not observed in the boring for the central VW.

A proposed grid for the soil gas survey is also presented in Figure 3.1. This grid includes 23 grid locations, but the actual number sampled will likely be less. Soil gas samples will be analyzed using field instruments to measure oxygen, carbon dioxide, and TVH. Sampling will begin in the center of the grid, and extend outward in each direction until screening results indicate that grid points are outside the extent of contamination. Soil gas samples will be collected at each grid point at 6 foot intervals, to a maximum depth of 18 feet bgs, using a Geoprobe® hydraulic sampler.

Soils in the proposed area are expected to be contaminated with fuel residuals and oxygen depleted. Biological activity should be stimulated in these areas by injecting oxygen into subsurface soils during pilot test operations. Effectiveness at providing fresh air (oxygen) to contaminated soils at depths below the depth of the plastic lining and laterally across the site is a primary factor in assessing the feasibility of bioventing at the site. The potential radius of venting influence around the central VW is expected to be between 25 and 40 feet. Therefore, the three vapor MPs (MPA, MPB, and MPC) will be located at distances of 10, 20, and 35 feet from VW (Figure 3.1).

The VW will be constructed of 2-inch-diameter schedule 40 polyvinyl chloride (PVC) casing, with up to a 20-foot interval of 0.04-inch slotted screen set across the zone of contamination. The zone of contamination is expected to extend no deeper than 25 feet; therefore, the screened interval is tentatively planned to extend from 7 to 27 feet bgs. This interval may vary depending on the actual thickness of contaminated soils found at the site. Flush-threaded PVC casing and screen with no organic solvents or glues will be used. The filter pack will be clean, well-rounded silica sand with a 4-10 or 6-9 grain size, and will be placed in the annular space to 1 foot above the screened interval. At least a 3-foot layer of bentonite will be placed directly over the filter pack and will extend above the plastic liner. The first 6 inches of bentonite will consist of bentonite pellets hydrated in place with potable water. This layer of pellets will prevent the addition of bentonite slurry from saturating the filter pack. The remaining bentonite will be fully hydrated and mixed aboveground, and the slurry will be placed into the annular space to produce an air-tight seal above the screened interval. The borehole will then be completed to the ground surface with a bentonite/cement grout. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. Figure 3.2 illustrates the proposed central VW construction detail for this site.

A typical multi-depth vapor MP installation for this site is shown in Figure 3.3. Assuming contamination extends to approximately 25 feet bgs, soil gas oxygen and carbon dioxide concentrations will be monitored at depths of 7 feet, 14 feet, and 21 feet bgs at each location. These intervals may be changed depending on the depth of contamination and plastic liner placement in the backfilled trench. Multi-depth

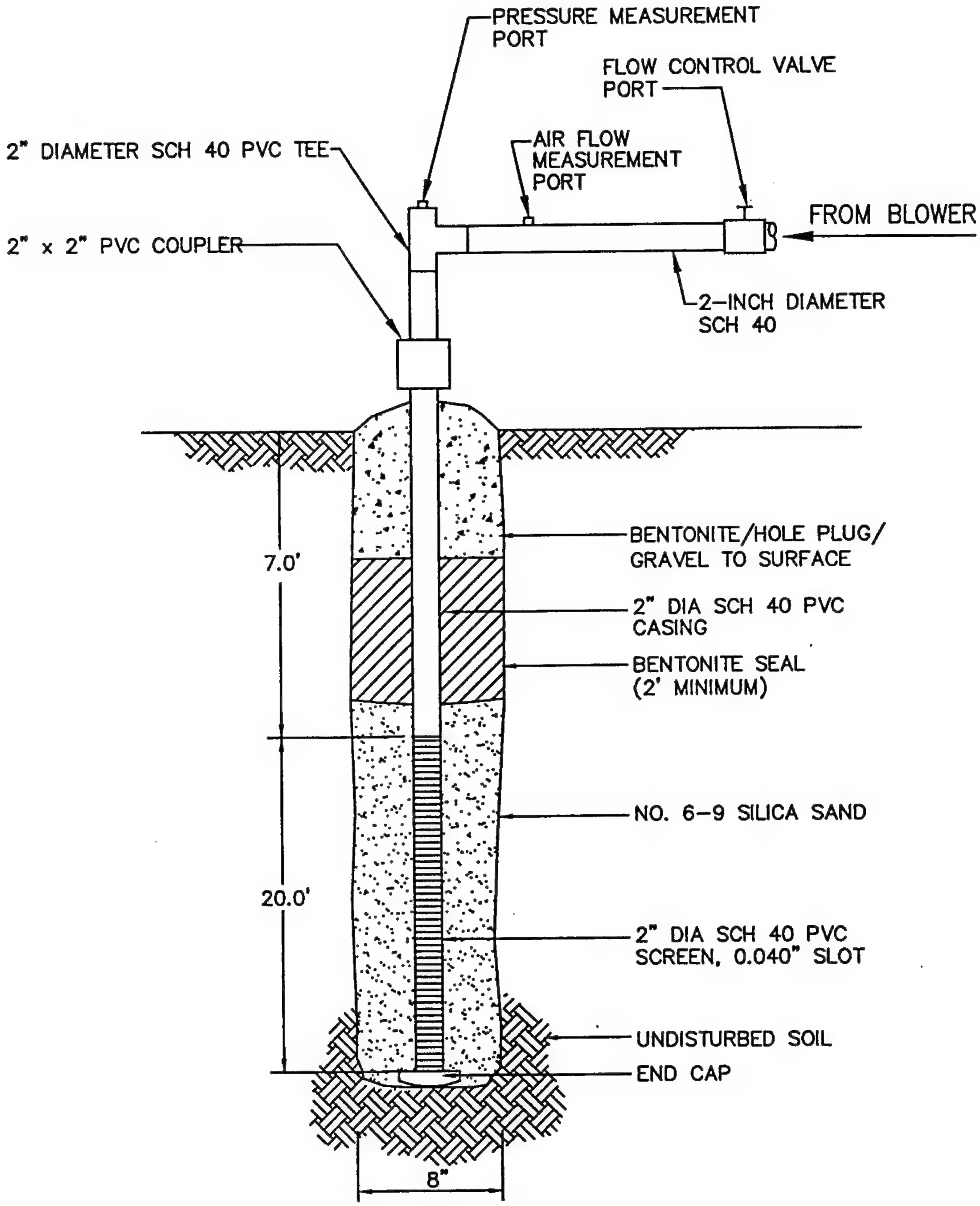


FIGURE 3.2
PROPOSED INJECTION VENT
WELL CONSTRUCTION DETAIL
LPST NO. 98508
PILOT TEST WORK PLAN
FORT BLISS, TEXAS

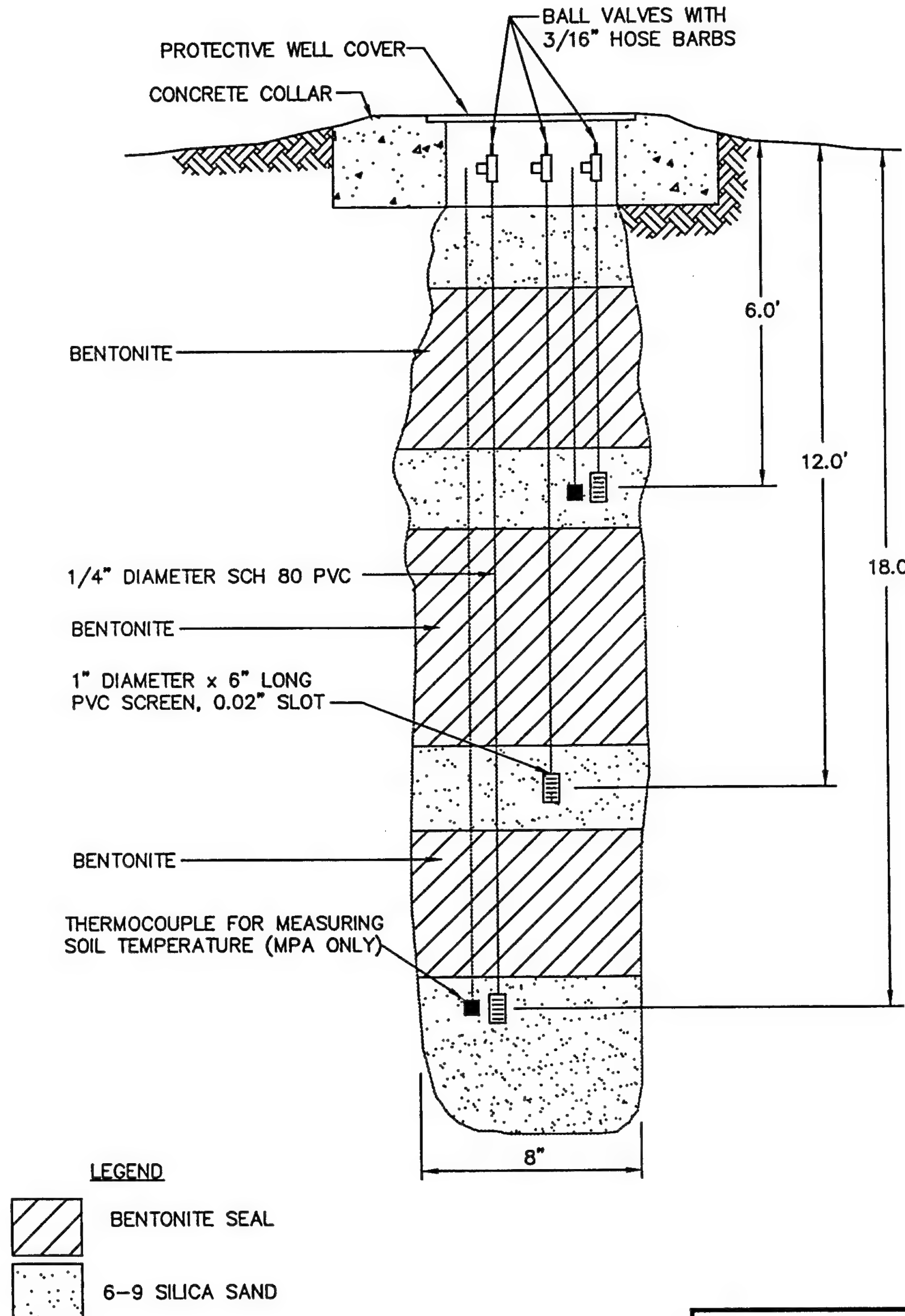


FIGURE 3.3
PROPOSED MONITORING POINT
CONSTRUCTION DETAIL
LPST NO.98508
PILOT TEST WORK PLAN
FT BLISS, TEXAS

DETFBLIS 1/30/96

monitoring will confirm that the entire soil profile is receiving oxygen and will be used to measure fuel biodegradation rates at the three depths. The annular spaces between the three screened MP intervals will be sealed with bentonite to isolate the monitoring intervals. As with the central VW, several inches of bentonite pellets will be used to shield the filter pack from rapid infiltration of bentonite slurry additions. Thermocouples will be installed at 7 feet and 21 feet bgs at MPA to measure soil temperature. Additional details on VW and MP construction are presented in Section 4 of the protocol document (Hinchee *et al.*, 1992). No MP intervals will be screened in the clean fill placed in the trench above the plastic liner because this soil will not likely be oxygen depleted and is located outside the treatment zone. The plastic sheets placed in the trench to separate clean fill from contaminated soils remaining in the trench will act as a barrier to air flow into the clean soils located within the plastic liner. The depths of the plastic barrier and clean fill material will be considered during the screen placement of pilot test VW and MPs.

3.2 Background Monitoring Point

Existing monitoring wells located in the vicinity of the site and screened at a depth similar to the MPs, may be used to assess background soil gas conditions at Fort Bliss. If initial soil gas samples indicate that any monitoring well in the vicinity of the site does not contain hydrocarbon contamination, and the samples contain oxygen in excess of 15 percent, that well may be selected as a background MP for soil gas testing.

If a suitable monitoring well is not identified, the construction of an additional vapor MP (MPBG) may be required to measure background levels of oxygen and carbon dioxide and to determine if natural carbon sources are contributing to oxygen uptake during the *in situ* respiration test described in Section 3.6. This background MP would be installed in an area of uncontaminated soil and in the same stratigraphic formation as the VWs and MPs. The background MP would be similar in construction to the MPs (Figure 3.3), and would be screened at three depths. One soil sample will be collected from the background boring for total kjeldahl nitrogen (TKN) analysis. Parsons ES may require assistance from Fort Bliss in selecting an appropriate location for the proposed background MP.

3.3 Handling of Investigation-Derived Waste

Drill cuttings and decontamination liquids from pilot test system installation will be collected and containerized in 55-gallon drums and stored in an area designated by Fort Bliss for temporary storage. Analytical results from soil sampling activities will be used to determine appropriate disposal options. Disposal of investigation-derived waste (IDW) will be performed in accordance with TNRCC regulations and will follow standard protocol at Fort Bliss.

3.4 Soil and Soil Gas Sampling

3.4.1 Soil Samples

Six laboratory soil samples will be collected from the pilot test area during the installation of the VW and MPs. Sampling procedures will follow those outlined in the protocol document. One sample will be collected from the most contaminated interval of the VW boring, and at least one sample will be collected from the intervals exhibiting indications of significant contamination in each of the borings drilled for the three MPs. Samples for laboratory analysis will be selected based on field screening of sample headspace with a photoionization detector (PID) to determine volatile organic compounds (VOCs). Soil samples will be analyzed for TRPH, BTEX, soil moisture, pH, particle sizing, alkalinity, total iron, and nutrients (nitrogen and phosphates). One additional sample will be collected from the background MP boring and analyzed for TKN.

Samples for TRPH and BTEX analysis will be collected by hand with stainless steel sampling spoons or using a split-spoon sampler containing brass tube liners. Soil samples collected in the brass tubes for TRPH and BTEX analyses will be immediately trimmed, and the ends will be sealed with aluminum foil or Teflon® fabric held in place by plastic caps. Hand-collected samples will be immediately placed in glass bottles with Teflon®-lined lids. Soil samples collected for physical parameter analyses will be placed in glass sample jars or other appropriate sample containers. Soil samples will be labeled following the nomenclature specified in the protocol document (Section 5), wrapped in plastic, and placed in a cooler for shipment. A chain-of-custody form will be filled out, and the cooler will be shipped by overnight delivery service to an AFCEE-approved analytical laboratory for analysis.

3.4.2 Soil Gas Samples

Prior to placement of the pilot test system, a soil gas survey using Geoprobe® will be performed to locate the most contaminated, and therefore most oxygen depleted, area of the site. All soil gas survey samples will be analyzed with handheld direct-reading instruments for oxygen, carbon dioxide, and TVH. Additionally, soil gas samples will be collected from each MP screened interval and tested for oxygen, carbon dioxide, and TVH using field instruments.

A total volatile organic vapor analyzer will be used during drilling activities to screen split-spoon soil samples for evidence of fuel contamination. Initial and final soil gas samples will be collected in SUMMA® canisters, in accordance with the bioventing field sampling plan (Engineering-Science, Inc., 1992). Soil gas samples will be collected from the VW and from the five MP intervals that appear to be most contaminated. Additionally, these soil gas samples will be used to predict potential VOC air emissions, to determine the reduction in BTEX and TVH following the 1-year pilot test, and to detect any migration of these vapors from the source area.

Soil gas sample canisters will be placed in a small cooler or box and packed with foam pellets or bubble wrap to prevent excessive movement during shipment. Soil gas samples will be sent at ambient temperature in order to prevent condensation of hydrocarbons. A chain-of-custody form will be filled out, and the cooler will be shipped to the Air Toxics, Inc., laboratory in Folsom, California, for analysis.

3.5 Blower System

A positive-displacement blower or a regenerative blower will be used to conduct the initial air permeability test. Air injection rates of 10 to 40 standard cubic feet per minute (scfm) are anticipated for initial testing. Figure 3.4 is a schematic of a typical air injection system used for bioventing pilot testing. The power requirement anticipated for this pilot test is 208-volt, single-phase, 30-amp service.

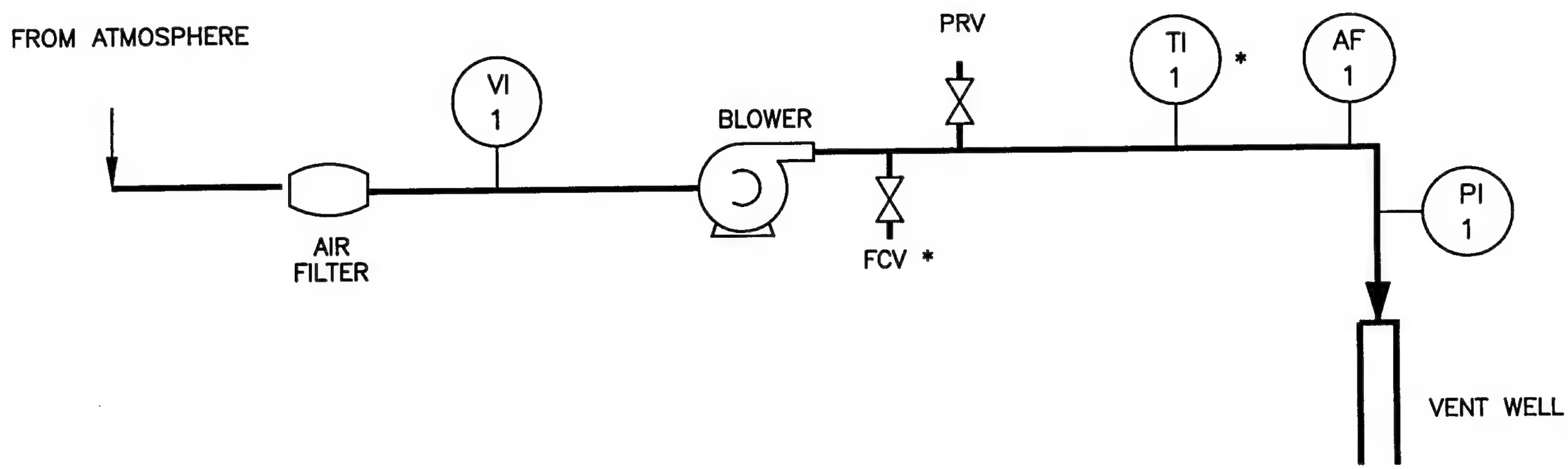
Fort Bliss is requested to provide a breaker box with 208-volt/single-phase/30 amp power, one 208-volt receptacle, and two 115-volt receptacles. The new breaker box should be located as near as possible to the proposed final blower shed location (near the VW location). A licensed electrician subcontracted by Parsons ES will perform the connections to the existing power source and assist in wiring the blower for power. Additional details on power supply requirements are described in Section 5, Facility Support Requirements.

3.6 *In Situ* Respiration Test

The objective of the *in situ* respiration test is to determine the rate at which the naturally occurring soil bacteria degrade petroleum hydrocarbons. Respiration tests will be performed at up to five vapor MP screens where bacterial biodegradation of hydrocarbons is indicated by low oxygen levels and elevated carbon dioxide concentrations in the soil gas. Using a 1-scfm pump, air will be injected into each MP depth interval containing low levels of oxygen. A 20-hour air injection period will be used to oxygenate the contaminated soils around each screened MP interval. At the end of the 20-hour air injection period, the air supply will be cut off, and oxygen and carbon dioxide levels will be monitored for the following 72 hours. The decline in oxygen and increase in carbon dioxide concentrations observed over time will be used to estimate rates of bacterial degradation of fuel residuals. A helium tracer also will be injected into the MP screened intervals to determine whether there are leaks (short circuiting of injected air) in the bentonite seals of MPs. Additional details on the *in situ* respiration test procedures are provided in Section 5.7 of the protocol document (Hinchee *et al.*, 1992).

3.7 Air Permeability/Oxygen Influence Testing

The objective of the air permeability tests is to determine the extent of the subsurface that can be oxygenated using the VW. Air will be injected into the 2-inch-diameter VW using the blower unit, and pressure response will be measured at each MP with differential pressure gauges to determine the region influenced by the unit.



LEGEND

- AF 1 — AIR VELOCITY GAUGE
- PI 1 — PRESSURE INDICATOR
- TI 1 — TEMPERATURE INDICATOR
- VI 1 — VACUUM PRESSURE INDICATOR
- FCV — FLOW CONTROL VALVE
- PRV — PRESSURE RELIEF VALVE
- * — OPTIONAL

NOT TO SCALE

FIGURE 3.4
BLOWER SYSTEM
INSTRUMENTATION DIAGRAM
FOR AIR INJECTION
LPST NO.98508
PILOT TEST WORK PLAN
FORT BLISS, TEXAS

DETFBLIS 1/30/96

Oxygen also will be monitored in the MPs to evaluate whether oxygen levels in the soil increase as the result of air injection. One air permeability test lasting 4 to 8 hours will be performed at the site.

3.8 Potential for Air Emissions

The potential for air emissions is considered low for this site. No free product remains at the site, and due to the nature and age of the release, BTEX concentrations in soil gas are assumed generally less than 1 part per million, volume per volume (ppmv) across the entire site. During initial air injection, health and safety monitoring will ensure that breathing zone hydrocarbon concentrations do not exceed background levels. Due to the soil conditions, the low injection rates of the blower system, and low BTEX levels detected in the soil, the potential for measurable emissions is very low.

3.9 Extended Pilot Test Bioventing System

If initial testing shows adequate soil/air permeability and oxygen transport, an extended bioventing system also will be installed. The blower system will be chosen based on the results of the respiration and air permeability tests. However, it is anticipated that the blower will have a flow rate in the range of 10 scfm and will not exceed 3 horsepower. The blower will be provided with vacuum, pressure, and temperature gauges, and air filters, pressure relief, and flow control valves (Figure 3.4). The blower will be manifolded to the VW and will be housed in small, prefabricated shed to provide protection from the weather. A licensed electrician subcontracted to Parsons ES will perform the connections between the breaker box and the blower. The power source will be the same as that used for the initial pilot test.

The system will be in operation for 1 year. After 1 year of operation, Parsons ES personnel will conduct soil gas sampling and an *in situ* respiration test to assess the long-term performance of this bioventing system. System checks should be performed once every 2 weeks by Fort Bliss personnel. If required, major maintenance of the blower unit may be performed by Parsons ES personnel. Detailed blower system information and a maintenance schedule will be included in the operation and maintenance (O&M) manual provided to Fort Bliss.

4.0 EXCEPTIONS TO PROTOCOL PROCEDURES

The procedures that will be used to measure the air permeability of the soil and *in situ* respiration rates are described in Sections 4 and 5 of the protocol document (Hinchee *et al.*, 1992). No exceptions to the protocol procedures are anticipated.

5.0 FACILITY SUPPORT REQUIREMENTS

The following support form Fort Bliss is needed prior to the arrival of the drilling subcontractor and the Parsons ES pilot test team:

- Assistance in obtaining drilling and digging permits.

- Assistance in selecting a suitable location for the background MP. The background MP location should be in an area with no fuel contamination and with stratigraphy similar to that of the site. Preferably, 110-volt receptacle power will be available within 150 feet of the background MP location.

- Installation of a new breaker box as close as practical to the proposed blower location. The breaker box should include a 208-volt, 30-amp, single-phase service and a breaker box with one 208-volt receptacle and two 115-volt/30-amp receptacles.

- Provision of any paperwork required to obtain gate passes and security badges for approximately three Parsons ES employees, three drillers, and an electrician (if a fort electrician is not available). Vehicle passes will be needed for one truck, a Geoprobe® sampling vehicle, and a drill rig.

During the initial testing, the following fort support is needed:

- An area near the site needs to be designated where the driller can construct a small decontamination pad to clean augers between borings.

- Signing of transport manifests by Fort Bliss for IDW including cuttings from VW and MP borings and decontamination water.

- Access to a telephone in a building located as close to the site as practicable.

- The use of a facsimile machine for transmitting 15 to 20 pages of test results.

During the 1-year extended pilot test, Fort Bliss personnel will be required to perform the following activities:

- Check the blower system once every 2 weeks to ensure that it is operating properly, record the air injection pressure and temperature, and change air filters when required. Parsons ES will provide a brief training session on these procedures and an O&M manual.

- If the blower stops working, notify Mr. Brian Vanderglas of Parsons ES-Austin at (512) 719-6000, Mr. John Ratz of Parsons ES-Denver at (303) 831-8100, Mr. Gene Fabian of USAEC at (410) 612-6847, Lt. Maryann Jenner of AFCEE at (210) 536-5688, or Mr. Marty Faile of AFCEE at (210) 536-4342.

- Arrange site access for an Parsons ES technician to conduct *in situ* respiration tests and soil gas sampling approximately 1 year after the initial pilot test.

6.0 PROJECT SCHEDULE

The following schedule is contingent upon timely approval of this pilot test work plan.

Event	Date
Draft Test Work Plan to AFCEE/Fort Bliss	2 February 1996
Final Test Work Plan at AFCEE/Fort Bliss	1 March 1996
Notice to Proceed	8 March 1996
Begin Initial Pilot Tests	8 April 1996
Complete Initial Pilot Tests	19 April 1996
Operations and Maintenance Manual completed	17 May 1996
Results Report completed	31 May 1996
Perform 12-month soil gas sampling and *in situ* respiration testing	April 1997

7.0 POINTS OF CONTACT

Mr. Bob Lenhart
CDR, USAADACENFG
Directorate of Environment
Fort Bliss, Texas 79916-6816
(915) 568-6959
Fax: (915) 568-1333

Mr. Gene Fabian
US Army Environmental Center
Attn: SFIM-AEC-ETD
Bldg. E4430
APG-EA, MD 21010-5401
(410) 612-6847
Fax: (410) 612-6836

Mr. John Ratz
Parsons Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, Colorado 80290
(303) 831-8100
Fax: (303) 831-8208

Lt. Maryann Jenner
USAF-HQ AFCEE/ERT
8001 Arnold Drive
Brooks AFB, Texas 78235-5357
(210) 536-5688
Fax: (210) 536-4330

Mr. Brian Vanderglas
Parsons Engineering Science, Inc.
8000 Centre Park Drive, Suite 200
Austin, Texas 78754
(512) 719-6000
Fax: (512) 719-6099

8.0 REFERENCES

Ayub. 1991. Personnel communication from Elizabeth Ayub, Corps of Engineers, to B. Barnes, on March 5, 1991.

BEG. 1983. Geologic Atlas of Texas. VanHorn-El Paso Sheet.

EA Remediation Technologies, Inc. (EA). 1991. Underground Storage Tank Closure Form, prepared for Building 675, Fort Bliss, Texas.

Engineering-Science, Inc. 1992. *Field Sampling Plan for AFCEE Bioventing*. April. Denver, CO

Hinchee, R.E., S.K. Ong, R.N. Miller, D.C. Downey, and R. Frandt. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing*. January.

Laidlaw. 1994. Underground Storage Tank Removal Building 675, Fort Bliss, Texas. Prepared for Directorate of Contracting, Fort Bliss, Texas, by Laidlaw Environmental Services, Inc., July.

Parsons Engineering Science, Inc. 1995. Volume I: Site Closure Investigation Report for the Former Fire Training Area and Contiguous Drum Storage Area, Fort. Bliss, Texas, prepared for U.S. Army Corps of Engineers, by Parsons Engineering Science, Inc., January 1995.

Soil Conservation Service (SCS). 1971. Soil Survey of El Paso County, Texas.

Sunbelt Laboratories, 1991. Results of soil sampling by EA Remediation Technologies, Inc., for project: Underground Storage Tanks, Site 675, El Paso, Texas, results dated March 21, 1991.

Texas Water Commission (TWC). 1991. Petroleum Storage Tank Release Incident Report, received April 24, 1991.

Texas Water Development Board (TWDB). 1980. Groundwater Development in the El Paso Region, Texas, with emphasis on the Lower El Paso Valley, Report 246.

9.0 LABORATORY ADDRESSES

Laboratory for Soil Samples:
Not yet selected

Laboratory for Soil Gas Samples:
Air Toxics, Inc.
180 Blue Ravine Road, Suite B
Folsom, California 95630
(916) 985-1000